

What is claimed:

1. A method for use in monitoring a patient, comprising the steps of:
obtaining a photoplethysmographic ("pleth") signal that is modulated
5 based on interaction of a transmitted optical signal with blood of said patient;
processing said pleth signal to identify an effect related to a Mayer Wave;
and
providing an output related to said Mayer Wave effect.

10 2. A method as set forth in Claim 1, wherein said step of processing
comprises identifying a variation in blood volume.

15 3. A method as set forth in Claim 1, wherein said step of processing
comprises extracting from said pleth signal information regarding at least one of
the amplitude and the frequency of the Mayer Wave.

20 4. A method as set forth in Claim 1, wherein said step of processing
comprises filtering the pleth signal to extract information regarding the Mayer
Wave.

5. A method as set forth in Claim 4 wherein said step of filtering comprises
band pass filtering the pleth signal using a frequency band that passes a spectral
peak of said pleth signal located between about 0.05 Hz and 0.5 Hz.

25 6. A method as set forth in Claim 4, wherein said step of filtering comprises
band pass filtering the pleth signal using a frequency band that passes a spectral
peak of the pleth signal located at about 0.1 Hz.

7. A method as set forth in Claim 1, wherein said step of providing an output
30 comprises providing a graphical output that shows at least one of an amplitude
and a frequency of the Mayer Wave.

8. A method as set forth in Claim 7, further comprising monitoring one of said amplitude and said frequency over time to detect a variation of interest.

9. A method as set forth in Claim 1, wherein said step of processing comprises first analyzing said pleth signal to obtain heart rate information.

10. A method as set forth in Claim 9, wherein said step of first analyzing comprises determining a period of a waveform of said pleth signal.

10 11. A method as set forth in Claim 9, wherein said step of first analyzing comprises filtering said pleth signal to obtain said heart rate information.

12. A method as set forth in Claim 9, wherein said step of processing further comprises monitoring said heart rate information over time to obtain a time series of heart rate values.

13. A method as set forth in Claim 9, wherein said step of processing further comprises second analyzing said heart rate information to obtain information regarding heart rate variability.

20 14. A method as set forth in Claim 9, wherein said heart rate information comprises a time series of heart rate values and said step of processing further comprises filtering said time series of heart rate values to identify a low frequency variability therein.

25 15. A method as set forth in Claim 14, wherein said low frequency variability is in the range between about 0.05 Hz and 0.5 Hz.

30 16. A method as set forth in Claim 14, wherein said low frequency variability is at about 0.1 Hz.

17. A method for use in monitoring a patient comprising the steps of:
obtaining a photoplethysmographic ("pleth") signal that is modulated
based on interaction of a transmitted optical signal with blood of said patient;
processing said pleth signal to obtain information regarding a low
frequency blood volume variation of said patient, said low frequency blood
volume variation relating to a spectral peak of said pleth signal located between
about 0.05 Hz and 0.5 Hz; and
monitoring said low frequency blood volume variation over time to identify
a characteristic of interest.

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18. A method as set forth in Claim 17, wherein said step of processing
comprises band pass filtering the pleth signal using a frequency band that
passes a spectral peak of the pleth signal located between about 0.05 Hz and
0.5 Hz.

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19. A method as set forth in Claim 17, wherein said step of processing
comprises band pass filtering the pleth signal using a frequency band that
passes a spectral peak of the pleth signal located at about 0.1 Hz.

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20. A method as set forth in Claim 17, further comprising the step of providing
a graphical output that shows at least one of an amplitude and a frequency of the
low frequency blood volume variation.

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21. A method as set forth in Claim 20, wherein said step of monitoring
comprises monitoring one of said amplitude and said frequency over time to
detect a variation of interest.

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22. A method for use in monitoring a patient, comprising the steps of:
obtaining a photoplethysmographic ("pleth") signal that is modulated
based on interaction of a transmitted optical signal with blood of said patient;
first processing said pleth signal to obtain heart rate information;
5 second processing said heart rate information to obtain information
regarding heart rate variability; and
monitoring said heart rate variability information to identify a characteristic
of interest.

10 23. A method as set forth in Claim 22, wherein said step of first processing
comprises determining a period of a waveform of said pleth signal.

15 24. A method as set forth in Claim 22, wherein said step of first processing
comprises filtering said pleth signal to obtain said heart rate information.

20 25. A method as set forth in Claim 22, wherein said step of first processing
comprises obtaining a time series of heart rate values.

26. A method as set forth in Claim 22, wherein said heart rate information
comprises a time series of heart rate values and said step of second processing
comprises filtering said time series of heart rate value to identify a low frequency
variability therein.

25 27. A method as set forth in Claim 26, wherein said low frequency variability is
in the range between about 0.05 Hz and 0.5 Hz.

28. A method as set forth in Claim 26, wherein said low frequency variability is
at about 0.1 Hz.

29. A method for use in monitoring a patient, comprising the steps of:
configuring a photoplethysmographic ("pleth") instrument relative to a
patient for a pleth analysis;
causing a respiration rate of said patient to be at least at a given
5 threshold;
first operating said pleth instrument to obtain a pleth signal for said patient;
and
second operating said pleth instrument to process said pleth signal for
identifying an effect related to a Mayer Wave and providing an output related to
10 said Mayer Wave effect.

30. A method as set forth in Claim 29, wherein said step of configuring
comprises applying a probe of said instrument to said patient so as to transmit an
optical signal to perfused tissue of said patient.

31. A method as set forth in Claim 29, wherein said step of causing comprises
instructing said patient to breathe at at least a predetermined threshold.

32. A method as set forth in Claim 31, wherein said predetermined threshold
20 is at least 10 breaths per minute.

33. A method as set forth in Claim 31, wherein said predetermined threshold
is at least 20 breaths per minute.

25 34. A method as set forth in Claim 29, wherein said step of causing comprises
controlling said patient's respiration rate with a respirator.

35. A method as set forth in Claim 29, wherein said step of second operating
comprises causing said instrument to process said pleth signal to obtain heart
30 rate information and process said heart rate information to obtain information
regarding heart rate variability.

36. A method as set forth in Claim 29, wherein said step of second operating comprises causing said instrument to process said pleth signal to obtain information regarding a low frequency blood volume variation of said patient.

5 37. An apparatus for use in monitoring a patient, comprising:
a port for receiving a photoplethysmographic ("pleth") signal that is modulated based on interaction of a transmitted optical signal with blood of said patient;
a processor for processing said pleth signal to identify an effect related to
10 a Mayer Wave; and
an output device for providing an output related to said Mayer Wave effect.

15 38. An apparatus as set forth in Claim 37, wherein said processor is operative for identifying a variation in blood volume.

20 39. An apparatus as set forth in Claim 37, wherein said processor is operative to filter the pleth signal to extract information regarding the Mayer Wave.

40. An apparatus as set forth in Claim 37, wherein said output device is operative to provide a graphical output that shows at least one of an amplitude and a frequency of the Mayer Wave.

25 41. An apparatus as set forth in Claim 37, wherein said processor is operative for analyzing said pleth signal to obtain heart rate information.

42. An apparatus as set forth in Claim 41, wherein said processor is further operative for analyzing said heart rate information to obtain information regarding heart rate variability.